which serve to direct, relieve, and repair certain defects of the equilibrium. Even when the physician's utmost power is exerted, when the part in question is cut off or destroyed, then also, restoration of the bodily equilibrium is necessary before any tolerable result can be produced. Also, when the healing powers remove certain imperfections, when an acid is neutralized by an alkali, or when a dormant faculty is roused into fresh activity by any excitation, the cure can only be perfect if the natural relations return again, or else if new ones are formed. Every outward effect is only a means by which to lead the inward formation of the body to free and regular action.

No physician can trust wholly to nature, but neither can he produce by art that which takes place naturally in the body. That is the work of the organic healing powers. Every medical man must rely upon their efficiency, but at the same time he has no right to sit idle with his hands in his lap in consequence. On the contrary it is frequently necessary to employ the most forcible interference in order to regulate the action properly. In particular diseases, how much nature is able to perform, and how much the physician is compelled to do, can only be ascertained by personal experience, and can be determined *a priori* by no theory. On the other hand, how far, in certain cases, medical treatment must extend, and how far the natural course is to be influenced by the physician, is not merely a question of experience, but frequently one of scientific value, which only an educated and cultured physician is capable of undertaking. Experience alone, in the medical world, produces only adventurers who perhaps may succeed now and then, but for whom self-reliance is always a risk. Such experience as is led and regulated by Science alone is capable of removing all barriers, and able to designate the realm in which nature and the physical organic forces have the supreme command.

SEPARATION OF CADMIUM AND ZINC.—In a memoir inserted in the *Annales de Chimie et de Physique* (Series 4, vol. 30, p. 351), M. Riche described a process for the determination of zinc, either by the decomposition of the acetate or by the electrolysis of the solution containing sulphuric acid. Several researches on the same subject have since been published by different authors. MM. Beilstein and Jawein, whilst confirming the results of Riche, employ the following process:—The nitric or sulphuric solution of zinc is mixed with caustic soda until precipitation ensues, and then with potassium cyanide till the precipitate is re-dissolved; the electrolysis is then effected with four Bunsen elements. The determination of cadmium has been effected by the same chemist under the same circumstances by means of the current from three elements. M. Millot has recently given a process for the determination of zinc by electrolysis of a solution of this metal in potassa. M. Edgar Smith obtains a precipitate of metallic cadmium by passing a strong current through a solution of the acetate. These procedures have the defect of not serving for the separation of cadmium and zinc, as the two metals are precipitated simultaneously. They may be separated as follows:—The solution containing the two metals in the state of acetates is mixed with 2 or 3 grms, sodium acetate, and a few drops of acetic acid. The current from two Daniell elements is then passed through the solution as described by M. Riche in his memoir. The cadmium alone is deposited in a crystalline layer at the negative pole, the zinc remaining in solution. The process requires the aid of heat, and requires three to four hours for quantities of 0·180 grm. to 0·210 grm. cadmium, and as much zinc. The deposit is effected in the crucible, and the liquid is then drawn off and serves for the determination of the zinc, according to M. Riche's process The deposit is washed first with water, then with alcohol, dried, and weighed. If the zinc and cadmium are present as sulphates the author recommends precisely the same method. Or the sulphuric solution may be mixed with ammonia and ammonium sulphate.—A. YVER.

MANUFACTURE OF YEAST WITHOUT ALCOHOLIC FERMENTATION.

A method of manufacturing yeast without alcoholic fermentation, and without the formation of subsidiary products has been patented in England by Dr. J. Rainer, of Vienna. The process is carried out in the following manner:—The vegetable albuminous substances in the corn cereals or other vegetables, or such refuse of industrial establishments as bran cornings, malt residuum, gluten, and the like, are extracted with the aid of from 15 to 20 parts by measure of water, made slightly alkaline. They are then either peptonized by adding an excess of lactic acid (about 4 per cent.) or mineral acids (about .25 per cent. of phosphoric acid, or about .4 per cent. of either sulphuric acid or hydrochloric acid) at a temperature of from 55 to 100 degrees Fahrenheit, or they are at once macerated in dilute solutions of the above acids and simultaneously converted into peptone. A portion of the albuminous substances (from 5 to 10 per cent. of the total weight) in the dried cornings will be already transformed into peptone by the process of vegetation. The albuminous substances in cereals, maize, or other vegetables, and in bran and malt residuum are transformed into peptone by the addition of diastase. In order to effect the conversion it is sufficient to add to one part by weight of the albuminous matter when dry, one part by weight of dry malt, or five parts by weight of cornings. As stated the liquid in which the albuminous matter is to be transformed into peptone must contain lactic acid (4 per cent.), phosphoric acid (as much as .25 per cent.), sulphuric acid or hydrochloric acid (about .4 per cent.), because the presence of an acid is absolutely necessary in the process of converting these substances into peptone.

A temperature of about 100 degrees Fahrenheit is the most suitable for the conversion of the substances into peptone, and a period of from 18 to 20 hours will be sufficient to effect it. It may, however, be also carried out at lower temperatures during a correspondingly longer time. In working cornings it is superfluous to add malt, because the diastase contained in the cornings is more than sufficient for the process of conversion into peptone. Therefore it is only necessary in this case to use one of the above-named acids in the proportions given. The slimy pectates contained in the cornings as well as in other materials are dissolved by the combination of diastase and acids. When the preparation of pure peptone is required the pectates may be separated by an endosmotic apparatus or dialysator, in such a manner that the peptone is dialysed through proper membranes in water, while the gelatinous pectates remain as a residuum. The acids are neutralized by means of soda, or by saturating the liquid with basic phosphate of lime. The prepared peptone liquid, with or without a percentage of sugar, may be shipped as a saleable article, or it may be delivered in a dry state, or as a syrup or extract obtained by boiling the liquid down in a water bath, by steam, or preferably in a vacuum. The liquid containing peptone may be separated from solid matter (hydrocarbons, vegetable fibre, or the like) by simple extraction, maceration, or pressure, or by centrifugal action, or it may be carefully cleaned by filtration or settling. It is advisable, however, before cleaning by filtration or settling to naturalize any acid present by means of soda, or to saturate the liquid with basic phosphate of lime, the latter being preferable because the phosphoric acid required by the yeast is thus abundantly furnished to it. In order to start the growth of yeast, gelatinized starch is added after being transformed in the usual way into dextrose by boiling with an addition of mineral acids. In the place of starch thus prepared an addition may be made of maltose, molasses, or sugar mixed with beer-yeast or compressed yeast. The amount thus added should correspond to the percentage of pep-

tone in the liquid, being one-half of the dry weight of the peptone. The hydrocarbons should, however, always be only from .5 to 1 per cent. of the weight of the entire liquid, and should even then serve exclusively for the formation of the walls of the cells of the yeast.

The vegetation of the yeast will take place most satisfactorily at temparatures varying from 57 to 64 degrees Fahrenheit. At a higher temperature losses may easily occur by reason of the partial conversion of the sugar used into coagulated acid or into alcoholic fermentation, instead of furnishing the yeast with substance for cells. The yeast is either propagated, as is the custom in Holland, in shallow vessels in which the depth of liquid is about five inches, so that a sufficient quantity of atmospheric air has access thereto; or it may be better and more safely effected in vats made of wood, glass, masonry, cement, or other suitable material, into which atmospheric air is conducted by suitable distributors through tubes or pipes by means of blowers or compressers.

Instead of atmospheric air alone it is more advantageous to use air containing an increased amount of ozone or of oxygen partially converted into ozone. The latter is prepared by successively adding hydrogen dioxide to the propagated liquid. The percentage of ozone in the air is increased by means of phosphorus, or by causing it to pass through a closed vessel in which permanganate of potassa is mixed with the necessary quantity of mineral acid. The air thus enriched with ozone is then allowed to pass into the propagating liquid.

The growth of the yeast will be completed within from 6 to 8 hours after every sufficient addition of dextrose, maltose, or other material, according to the density of the propagating liquid used, the temperature of the latter, and the amount of the ozone in the air. The percentage of peptone of the mass may amount to from 1 to 2 per cent. or more of its weight, while only from one-half to one per cent. of dextrose or other hydrocarbons is added at each time, in order to be sure to prevent the formation or coagulated lactic acid or alcoholic fermentation.

When the entire amount or bulk of the dextrose or other sugar added to promote the growth of the yeast has been consumed after from six to eight hours, a further quantity thereof, say, from .05 to .10 per cent. is added. The peptone may also, after having been consumed, be added in portions, or may be allowed to flow in gradually and continuously. The same propagating liquid made by successive replacement of the matter consumed remains in use for weeks or months, unless it is rendered impure by other substances, or by subsiding fermentation is made unfit for further use. In the same manner as the materials necessary for the propogation of the yeast are added the yeast produced may be successively withdrawn, and only the yeast suspended in the liquid remains behind as the germ for the ferments of alcohol to be afterwards formed. The yeast is obtained either by skimming it from the surface of the liquid or by separating it from the propagating liquid by filtration, or finally by gathering it after tapping the vats from the bottom upon which it is deposited in a compact layer. In working on a large scale it is advisable to place the vats in terraced batteries in order to effect the transfer of the propagating liquid from one vessel to the other with facility. In order to produce yeast as free as possible from subsidiary ferments the propagating liquid may be prepared in a more dilute state, that is to say, with a percentage of peptone of only from .75 to 1 per cent. The hydrocarbons (dextrose, maltose, or the like) may also be added in smaller quantities, for example, as a first dose about .33 per cent. and then every 3 hours about .05 per cent.

The greater part of the peptone present will then be transformed into yeast in from 12 to 15 hours, a sufficient supply of pure air, if necessary, conducted through sulphuric acid or oxygen containing ozone, being provided, and the entire process being carried on at a temperature varying from 54 to 63 degrees Fahrenheit. The whole liquid is then cooled by a suitable apparatus, or by adding cold water or ice; the best temperature being from 45 to 50 degrees Fahrenheit. Within from 36 to 48 hours the yeast obtained will settle on the bottom of the vat. The propagating liquid may be allowed to flow away. The yeast obtained by this improved process is purified and condensed in the usual manner, but in order to increase its durability phosphate of lime amounting to from 4 to 5 per cent. of the total weight of the yeast to be made may be added before compressing it.

Experience has shown that from 250 to 300 parts of pure and active compressed yeast may be obtained from 100 parts of pure peptone. For the growth of that quantity of yeast only about 200 parts of dextrose or sugar are required.

MICROSCOPY.

We have received the February issue of the Journal of the Royal Microscopical Society, now edited by Mr. Frank Crisp, one of the secretaries of the society. It contains a valuable and interesting original paper, with two full-page illustrations, and the proceedings of the R. M. C. A summary is also presented of current research in those departments of science, depending upon the use of the microscope for their advancement. The amount of information thus gathered may be estimated from the fact that the present number is a volume of one hundred and seventy-two pages. The Journal appears bi-monthly, and costs one dollar (4*s.*) for each part.

The President of the Royal Microscopical Society announced that a fund had been provided for the presentation of two gold medals annually, without regard to nationality—one for the person who should originate any important improvement in the microscope, or any of its accessory apparatus, or in any other way eminently contribute to the advancement of the microscope as an instrument of research. The second gold medal was to be awarded "in respect to any researches in any subject of natural science carried on wholly, or in a great part, by means of the microscope, or of the recipient having in other ways eminently contributed to the advancement of research in natural science in connection with the microscope."

The two medals were to be known respectively as the "Microscopical" and "Research" medals of the Society. For reasons which are not stated, the offer of this fund was declined by the Council of the Society.

The war of Apertures of Microscope Objectives has again broken out in the R. M. S. In this instance Mr. Shadbolt was the aggressor, who claimed that his paper demonstrated beyond dispute the following facts, viz.:

"That a dry lens can have as large an 'angular aperture' as an immersion one, and that the assumed difference of aperture between dry and immersion lens does exist."

"That no lens can have an 'aperture' of any kind which exceeds that of 180° angular in air."

"That, consequently, the table of 'numerical apertures' published on the cover of the *Journal* of the Society is erroneous and misleading, and should at once be discontinued."

In reply, Mr. Crisp asserted that Mr. Shadbolt was in error, and the victim to a misplaced confidence in a fundamental fallacy, viz., "the supposition that equal angles in different media, as air and oil, are optically equivalent."

A correspondent, who is an authority on this subject, will offer an opinion on this matter. We believe, however, that Mr. Crisp is correct in his views, and that the society has exercised a wise discretion in putting a stop to a discussion, which had become wearisome and unprofitable.

Mr. Crisp showed how a few moss-grown English microscopists had persistently refused to countenance